RECEIVED

UCAR CARBON COMPANY INC.

O.W.H. **IDEA RECORD** CP-02-01-GRSP-01

(for use by IP Counsel to make patentability determination)

BUSINESS CONFIDENTIAL and
SUBJECT TO ATTORNEY-CLIENT PRIVILEGE

Date:
Submitted by: Dai Huang and Irv Lewis
Subject: **Carbon/SiC composites.**

Description: *(Type or neatly handwritten brief summary; send to Manager, Intellectual Property Dept., Parma)*

The flexibility of the BP process gives us several ways to make C/SiC composites. The combination of C/SiC in a composite provides improved friction performance compares to C/C composite alone.

1) SiC particle addition. Add SiC particles as filler materials with carbon fibers and pitch binder during the mixing. The mix will go through hot pressing at about 900 C. The hot-pressed material will go through PI/rebake process. Finally, the material is graphitized at the temperature around 2600 C. SiC particles can be added within a rang of 5 to 20 wt% or even higher. The particle size can be varied from several microns to several hundred microns;
2) SiO2 particle addition. SiO2 particles can be added with the carbon fibers as filler materials with the pitch binder during mixing. The mix will go through hot pressing at about 900 C. The hot-pressed material will go through a PI/rebake process. Lastly, the material is subjected to a high temperature treatment to accomplish SiC conversion and graphitization. In the first stage, the material is held to 1700-1800 C with a hold of 2-4 hours. During this temperature rang, SiO2 will convert into SiC. After the conversion, the material is heated to a temperature of 2400 to 2600 C to achieve graphitization. The SiO2 particles can be added in a range of 5 to 20 wt% or higher. The particles size can be from several microns powders to submicron;

3) SiO2 colloidal suspension impregnation. After producing the hot-pressed carbon fiber and pitch binder preform block, it can be impregnated with a colloidal SiO2 suspension using standard vacuum procedures. The SiO2 colloidal suspension contains about 30-50% of SiO2 submicron powders in water. After impregnation, the preform is dried to remove water and goes through the same process as indicated in 2) to convert impregnated SiO2 into SiC. It might be possible to use a suspension of fine SiC particles as an impregnant as well.

Inventor(s): _____ Witnessed: _____ Date: _____
Date: _____

Distribution:
Inventor(s)
TIS
J. Cartiglia/Wilmington
L. Batty
C. F. Chang

Reviewed:
1st _____
2nd _____
3rd _____

Review Date:
_____
_____
_____

RECEIVED

UCAR CARBON COMPANY INC.

O.W.H. **IDEA RECORD** CP-02-02-GRSP-02

(for use by IP Counsel to make patentability determination)

BUSINESS CONFIDENTIAL and
SUBJECT TO ATTORNEY-CLIENT PRIVILEGE

Date:
Submitted by: David R. Snyder, Dai Huang and Irv Lewis
Subject: **Carbon/carbon composites with post treatment with resin or metal for friction applications for passenger cars.**

Description: *(Type or neatly handwritten brief summary; send to Manager, Intellectual Property Dept., Parma)*

Carbon/carbon composites that are made by rapid hot-pressing technology (BP process) can be post treated with either resin or metal (Al, Cu, etc.). The starting carbon/carbon density after graphitization can be between 1.60 to 1.70. The phenolic resin or liquid metal can be impregnated under vacuum to obtain treated hybrid composites. The intention is to use these treated materials as friction materials in the consumer automobiles industry, so that they can rub against cast iron directly. The weight percentage of resin or metal can be determined by both friction property requirements and the starting graphitized CCC densities. For resin, the impregnation can be carried out using a liquid phenolic material. Followed by curing of the resin. The impregnation can be performed at room temperatures. For metals, high temperature is required to melt the metal.

Inventor(s): D. Huang, I. Lewis Witnessed: B. Bowman Date:
Richard Luthra Date:

Distribution:
Inventor(s)
TIS
J. Cartiglia/Wilmington
L. Batty
C. F. Chang

Reviewed:
1st: _____
2nd: _____
3rd: _____

Review Date:
_____
_____
_____

RECEIVED

UCAR CARBON COMPANY INC.

O.W.H. **IDEA RECORD** CP- 02-03-GRSP-03

(for use by IP Counsel to make patentability determination)

BUSINESS CONFIDENTIAL and
SUBJECT TO ATTORNEY-CLIENT PRIVILEGE

Date:
Submitted by: Dai Huang and Irv Lewis
Subject: **Graphite and coke flours as additives in carbon/carbon composite for friction application**

Description: *(Type or neatly handwritten brief summary; send to Manager, Intellectual Property Dept., Parma)*

Fine coke and/or graphite flours are added into carbon fiber and pitch binder mix to change friction characteristics of carbon/carbon composite made by UCAR rapid hot-press technology (BP process).

Fine coke and/or graphite particles, with the size range from 5 μm to 200 μm, or even larger particle size, are mixed with carbon fiber and pitch binder using either dry blending or hot mixing. The percentage of these particle additions range from 5% to 20%, or even higher, depending on the friction properties. The mix then is densified using the BP process. The material will go through pitch impregnation(s), rebake(s), and graphitization to produce carbon/carbon composites containing added coke/graphite particles. The final material is intended for friction applications.

Inventor(s): Dai Huang, I.D. Lewis Witnessed: B. Bowman Date:
Richard A. Hunt Date:

Distribution:	Reviewed:	Review Date:
Inventor(s)	1st: _____	_____
TIS	2nd: _____	_____
J. Cartiglia/Wilmington	3rd: _____	_____
L. Batty		
C. F. Chang		